1 Pressure of thermal radiation

(modified from K&K 4.6) We discussed in class that

$$p = -\left(\frac{\partial F}{\partial V}\right)_T \tag{1}$$

Use this relationship to show that

(a)

$$p = -\sum_j \langle n_j \rangle \hbar \left(\frac{d\omega_j}{dV}\right), \tag{2}$$

where $\langle n_j \rangle$ is the number of photons in the mode j;

(b) Solve for the relationship between pressure and internal energy.